

- 00011781-032001
1. A scintillation element package, comprising:
a scintillation element;
a shield encompassing said scintillation element; and
a flexible support sleeve at least partially surrounding said scintillation element
within said shield, said flexible support sleeve providing dynamic support for said
scintillation element.
 2. The package of claim 1, wherein said first flexible support sleeve is formed of a
material transparent to gamma radiation.
 3. The package of claim 2, wherein said first flexible support sleeve is formed of
stainless steel.
 4. The package of claim 1, wherein said first flexible support sleeve includes
bends and flat portions, said flat portions contacting said scintillation element and said
bends contacting said shield.
 5. The package of claim 4, wherein said bends promote friction between said
shield and said first flexible support sleeve thereby suppressing relative movement
between said shield and said first flexible support sleeve.
 6. The package of claim 4, wherein said flat portions are coated on a surface
facing said scintillation element.
 7. The package of claim 6, wherein said flat portions are coated with a dry
lubricant.

8. The package of claim 1, further comprising a reflector wrapped around said scintillation element.
9. The package of claim 8, further comprising an alumina powder between said reflector and said scintillation element.
10. The package of claim 8, wherein said reflector comprises polytetrafluorethylene.
11. The package of claim 8, wherein said reflector is in the form of a tape which is wrapped around said scintillation element.
12. The package of claim 8, wherein said reflector is in the form of a skived sheet.
13. The package of claim 8, further comprising a polyimide wrap surrounding said reflector.
14. The package of claim 13, further comprising a polyimide tape for holding said polyimide wrap in place.
15. The package of claim 14, further comprising a lubricant between said polyimide tape and said flexible support sleeve.
16. The package of claim 1, wherein said shield includes a plurality of stiffening rings.

09011781.032001

- 100250-18271860
17. A gamma detector, comprising:
a scintillation element; and
a first housing encompassing said scintillation element and including at least one window allowing said scintillation element to be exposed to gamma radiation, wherein said window is formed of a material including polyether ether ketone.
18. The gamma detector of claim 17, wherein said material forming said window is a multi-layer woven carbon-fiber matrix impregnated polyether ether ketone.
19. The gamma detector of claim 18, wherein said carbon fiber matrix makes up about sixty percent by volume of said material forming said window.
20. The gamma detector of claim 17, wherein said scintillation element comprises sodium iodide.
21. The gamma detector of claim 17, further comprising a photomultiplier tube.
22. The gamma detector of claim 21, wherein said photomultiplier tube includes a faceplate and a photo-cathode.
23. The gamma detector of claim 21, further comprising a buffer, amplifier, and peak detector.
24. The gamma detector of claim 21, further comprising an explosion-proof housing within said first housing and encasing said photomultiplier tube.

25. The gamma detector of claim 17, wherein said first housing comprises an armor material positioned to protect said gamma detector from flying debris.
26. The gamma detector of claim 25, further comprising a shield encompassing said scintillation element.
27. The gamma detector of claim 26, further comprising a rigid dynamic enclosure surrounding said shield and including an opening to allow gamma rays to enter said enclosure.
28. A gamma detector, comprising:
a scintillation element;
a shield surrounding said scintillation element; and
a first flexible support sleeve at least partially surrounding said scintillation element within said shield, said flexible support sleeve providing dynamic support for said scintillation element.
29. The gamma detector of claim 28, wherein said first flexible support sleeve is formed of a material transparent to gamma radiation.
30. The gamma detector of claim 29, wherein said first flexible support sleeve is formed of stainless steel.
31. The gamma detector of claim 28, wherein said first flexible support sleeve includes bends and flat portions, said flat portions contacting said scintillation element and said bends contacting said shield.

32. The gamma detector of claim 31, wherein said bends promote friction between said shield and said first flexible support sleeve thereby suppressing relative movement between said shield and said first flexible support sleeve.

33. The gamma detector of claim 31, wherein said flat portions are coated on a surface facing said scintillation element.

34. The gamma detector of claim 33, wherein said flat portions are coated with a dry lubricant.

35. The gamma detector of claim 28, wherein said shield includes a plurality of stiffening rings.

36. The gamma detector of claim 28, further comprising:
a rigid dynamic enclosure encompassing said shield; and
a second flexible support sleeve at least partially surrounding said shield within said rigid dynamic enclosure.

37. The gamma detector of claim 36, wherein said first and second flexible support sleeves each partially extend circumferentially around said scintillation element leaving a gap between said scintillation element and said rigid dynamic enclosure to allow entry of gamma rays.

38. The gamma detector of claim 37, wherein said rigid dynamic enclosure includes an opening and wherein said opening is aligned with and has at least as large a circumferential extent as said gap.

0911781.03200

39. The gamma detector of claim 38, wherein said enclosure includes a plurality of rings and fingers, said rings completely extending across said opening and said fingers partially extending across said opening.

40. The gamma detector of claim 28, further comprising an optical coupler optically coupled to a first end of said scintillation element.

41. The gamma detector of claim 40, further comprising an axial spring positioned at a second end of said scintillation element to bias said scintillation element toward said optical coupler.

42. The gamma detector of claim 28, further comprising:
a photo-metric module within a module housing, said photo-metric module including a photomultiplier tube;
a window positioned between said photomultiplier tube and said scintillation element; and
a second flexible support sleeve surrounding said photomultiplier tube within said module housing, said second flexible support sleeve providing dynamic support for said photomultiplier tube.

43. The gamma detector of claim 42, wherein said photomultiplier tube includes a faceplate and a photo-cathode.

44. The gamma detector of claim 42, wherein said photo-metric module includes a buffer, amplifier, and peak detector.

09811781.032001

45. The gamma detector of claim 42, further comprising:
an explosion-proof housing surrounding said module housing; and
a third flexible support sleeve surrounding said module housing within said explosion-proof housing, said third flexible support sleeve providing dynamic support for said photomultiplier tube.
46. The gamma detector of claim 45, further comprising:
a rigid dynamic enclosure encompassing said shield and said explosion-proof housing; and
a fourth flexible support sleeve surrounding said explosion-proof housing within said rigid dynamic enclosure, said fourth flexible support sleeve providing dynamic support for said photomultiplier tube.
47. A gamma detector system, comprising:
a gamma detector, including:
a scintillation element; and
a first housing encompassing said scintillation element and including at least one window allowing said scintillation element to be exposed to gamma radiation, wherein said window is formed of a material including polyether ether ketone;
armor material into which said gamma detector is located, said armor material for protecting said gamma detector from thrown debris; and

09811781.032001

at least one spray mechanism for removing dust and thrown debris from said at least one window.

48. The gamma detector system of claim 47, wherein said spray mechanism is integral with said armor.

49. The gamma detector system of claim 47, wherein said spray mechanism is attached to said armor.

50. The gamma detector system of claim 47, wherein said spray mechanism comprises a sprayer in fluid connection with a spray line.

51. The gamma detector system of claim 47, wherein said spray line is connected to said sprayer by a spray channel.

ADD
A-1

000220-18277860